AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A transmission control method for a mechanical transmission that transmits~~, capable of transmitting~~ an output of an internal combustion engine to wheels through a friction clutch by performing automatic multistage speed change, comprising:

a step (a) of controlling an engine torque generated by the internal combustion engine in response to a request for a gear shift of the mechanical transmission so that the value of a transfer torque of the friction clutch is 0 or near 0;

a step (b) of allowing the gear shift of the mechanical transmission when the engine torque is controlled so that the value of the transfer torque is 0 or near 0 in said step (a); and

a step (c) of disengaging and engaging gears with the clutch kept connected when the gear shift is allowed in said step (b),

wherein the step (c) includes a sub-step (c1) of changing an engine revolution speed of the internal combustion engine after the gear disengagement is performed with the clutch kept connected, and

wherein said internal combustion engine has an auxiliary brake, and said sub-step (c1) includes actuating the auxiliary brake if the engine revolution speed of the internal combustion engine exceeds an upper limit value of a predetermined revolution speed range including a target engine revolution speed corresponding to the gear revolution speed.

2. (Currently Amended) A transmission control method for a mechanical transmission according to claim 1, wherein said step (c) includes ~~a sub-step (c1) of changing an~~

~~engine revolution speed of the internal combustion engine after the gear disengagement is performed with the clutch kept connected and~~ a sub-step (c2) of performing the gear engagement for a gear stage after the ~~afterthe~~ gear shift with the clutch kept connected when the engine revolution speed is substantially synchronous with a gear revolution speed for the gear stage after the gear shift.

3. (Original) A transmission control method for a mechanical transmission according to claim 1 or 2, wherein the applicable mechanical transmission is configured so that said friction clutch can be automatically connected and disconnected, and the step (c) includes automatically disconnecting the friction clutch to disengage and engage the gears if gear disengagement is not executed after a command for gear disengagement is issued.

4. (Original) A transmission control method for a mechanical transmission according to claim 1, wherein said step (a) includes obtaining a changed engine torque such that the value of the transfer torque is 0 or near 0 in accordance with a first motion equation for a range from the internal combustion engine to the friction clutch and a second motion equation for a range from the friction clutch to each wheel and a position on an axle shaft of a vehicle, indicating the changed engine torque, and controlling the internal combustion engine so that the changed engine torque is generated.

5. (Original) A transmission control method for a mechanical transmission according to claim 4, wherein said first motion equation is transformed on condition that an

engine rotation angle acceleration on the axle shaft is equal to an axle shaft rotation angle acceleration on the axle shaft, and said step (a) includes obtaining the changed engine torque in accordance with the transformed first motion equation so that the value of the transfer torque is 0.

6. (Original) A transmission control method for a mechanical transmission according to claim 4, wherein said second motion equation is transformed on condition that an engine rotation angle acceleration on the axle shaft is equal to an axle shaft rotation angle acceleration on the axle shaft, and said step (a) includes obtaining the changed engine torque in accordance with the transformed second motion equation so that the value of the transfer torque is 0.

7. (Currently Amended) A transmission control method for a mechanical transmission according to claim 4, wherein said friction clutch has a flywheel and a clutch plate capable of being connected to and disconnected from the flywheel, a motion equation for a range from the internal combustion engine to the flywheel is used as the first motion equation, and a motion equation for a range from the clutch plate to each wheel and a position on the axle shaft is ~~shaftis~~ used as the second motion equation.

8. (Original) A transmission control method for a mechanical transmission according to claim 4, wherein said step (a) includes concluding that the value of the transfer torque is 0 or near 0 after the lapse of a predetermined period since the indication of the changed

engine torque.

9. (Original) A transmission control method for a mechanical transmission according to claim 1, wherein said internal combustion engine includes a fuel injection pump unit having a control rack for adjusting a fuel injection quantity, and the step (a) includes controlling the control rack, thereby controlling the engine torque.

10. (Original) A transmission control method for a mechanical transmission according to claim 9, wherein said step (b) includes determining whether or not the value of the transfer torque is 0 or near 0 based on the position of the control rack.

11. (Original) A transmission control method for a mechanical transmission according to claim 2, wherein said internal combustion engine has an auxiliary brake, and said sub-step (c1) includes actuating the auxiliary brake if the engine revolution speed of the internal combustion engine exceeds an upper limit value of a predetermined revolution speed range including a target engine revolution speed corresponding to the gear revolution speed.

12. (Original) A transmission control method for a mechanical transmission according to claim 2, wherein said sub-step (c1) includes correcting a target engine revolution speed corresponding to the gear revolution speed in accordance with the characteristics of the internal combustion engine.

13. (Original) A transmission control method for a mechanical transmission

according to claim 1, wherein said step (c) includes issuing a command to restore the engine torque after the lapse of a predetermined period since the start of gear engagement when a gear shift from a high-speed stage to a low-speed stage of the mechanical transmission is required by the gear shift request.

14. (Canceled)

15. (Currently Amended) A transmission control apparatus for a mechanical transmission, capable of transmitting an output of an internal combustion engine to wheels through a friction clutch by performing automatic multistage speed change, comprising:

engine revolution speed detecting means for detecting an engine revolution speed of the internal combustion engine;

engine torque control means for controlling an engine torque generated by the internal combustion engine so that the value of a transfer torque of the friction clutch is 0 or near 0 when a gear shift of the mechanical transmission is required;

gear shift allowing means for allowing the gear shift of the mechanical transmission when the engine torque is controlled by the engine torque control means so that the value of the transfer torque is 0 or near 0; and

gear shift executing means for disengaging and engaging gears with the clutch kept connected when the gear shift is allowed by the gear shift allowing means,

wherein said gear shift executing means changes the engine revolution speed of the internal combustion engine after the gear disengagement is performed with the clutch kept

connected, and

wherein said internal combustion engine has an auxiliary brake, and said gear shift executing means actuates the auxiliary brake if the engine revolution speed of the internal combustion engine exceeds an upper limit value of a predetermined revolution speed range including a target engine revolution speed corresponding to the gear revolution speed.

16. (Currently Amended) A transmission control apparatus for a mechanical transmission according to claim 15, further comprising: ~~which further comprises engine revolution speed detecting means for detecting an engine revolution speed of the internal combustion engine and~~

gear revolution speed detecting means for detecting a gear revolution speed for a gear stage after the gear shift, ~~and~~

wherein said gear shift executing means changes the engine revolution speed of the internal combustion engine after the gear disengagement is performed with the clutch kept connected and performs the gear engagement for the gear stage after the gear shift with the clutch kept connected when the engine revolution speed is substantially synchronous with the gear revolution speed for the gear stage after the gear shift.

17. (Original) A transmission control apparatus for a mechanical transmission according to claim 15 or 16, wherein said friction clutch is configured to be able to be automatically connected and disconnected, and the gear shift executing means automatically disconnects the friction clutch to disengage and engage the gears if gear disengagement is not

executed after a command for gear disengagement is issued.

18. (Currently Amended) A transmission control apparatus for a mechanical transmission according to claim 15, wherein said ~~whereinsaid~~ friction clutch has a flywheel and a clutch plate capable of being connected to and disconnected from the flywheel, and said engine torque control means obtains a changed engine torque such that the value of the transfer torque is 0 or near 0 in accordance with a first motion equation for a range from the internal combustion engine to the flywheel and a second motion equation for a range from the friction clutch to each wheel and a position on an axle shaft of a vehicle and controls the internal combustion engine so that the changed engine torque is generated.

19. (Currently Amended) A transmission control apparatus for a mechanical transmission according to claim 15, wherein said ~~whereinsaid~~ internal combustion engine includes a fuel injection pump unit having a control rack for adjusting a fuel injection quantity, and said engine torque control means controls the control rack, thereby controlling the engine torque.

20. (Canceled)

21. (New) A transmission control method for a mechanical transmission that transmits an output of an internal combustion engine to wheels through a friction clutch by performing automatic multistage speed change, comprising:

a step (a) of controlling an engine torque generated by the internal combustion engine in response to a request for a gear shift of the mechanical transmission so that the value of a transfer torque of the friction clutch is 0 or near 0;

a step (b) of allowing the gear shift of the mechanical transmission when the engine torque is controlled so that the value of the transfer torque is 0 or near 0 in said step (a); and

a step (c) of disengaging and engaging gears with the clutch kept connected when the gear shift is allowed in said step (b),

wherein the applicable mechanical transmission is configured so that said friction clutch can be automatically connected and disconnected, and the step (c) includes automatically disconnecting the friction clutch to disengage and engage the gears if gear disengagement is not executed after a command for gear disengagement is issued.

22. (New) A transmission control apparatus for a mechanical transmission, capable of transmitting an output of an internal combustion engine to wheels through a friction clutch by performing automatic multistage speed change, comprising:

engine torque control means for controlling an engine torque generated by the internal combustion engine so that the value of a transfer torque of the friction clutch is 0 or near 0 when a gear shift of the mechanical transmission is required;

gear shift allowing means for allowing the gear shift of the mechanical transmission when the engine torque is controlled by the engine torque control means so that the value of the transfer torque is 0 or near 0; and

gear shift executing means for disengaging and engaging gears with the clutch kept connected when the gear shift is allowed by the gear shift allowing means,

wherein said friction clutch is configured to be able to be automatically connected and disconnected, and the gear shift executing means automatically disconnects the friction clutch to disengage and engage the gears if gear disengagement is not executed after a command for gear disengagement is issued.

23. (New) A transmission control method for a mechanical transmission according to claim 1, wherein the auxiliary brake includes an exhaust brake provided in an exhaust pipe of the engine.

24. (New) A transmission control apparatus for a mechanical transmission according to claim 15, wherein the auxiliary brake includes an exhaust brake provided in an exhaust pipe of the engine.

25. (New) A transmission control method for a mechanical transmission that transmits an output of an internal combustion engine to wheels through a friction clutch by performing automatic multistage speed change, comprising:

a step (a) of controlling an engine torque generated by the internal combustion engine in response to a request for a gear shift of the mechanical transmission so that the value of a transfer torque of the friction clutch is 0 or near 0;

a step (b) of allowing the gear shift of the mechanical transmission when the engine torque is controlled so that the value of the transfer torque is 0 or near 0 in said step (a); and

a step (c) of disengaging and engaging gears with the clutch kept connected when the gear shift is allowed in said step (b),

wherein said step (a) includes obtaining a changed engine torque such that the value of the transfer torque is 0 or near 0 in accordance with a first motion equation for a range from the internal combustion engine to the friction clutch and a second motion equation for a range from the friction clutch to each wheel and a position on an axle shaft of a vehicle, and controlling the internal combustion engine so that the changed engine torque is generated,

wherein said first motion equation is a following equation, in which "Te" is engine torque, "Tcl" is clutch torque, "it" is a transmission gear ratio, "if" is a differential gear ratio, "Ie" is moment of inertia of rotating portion of an engine input shaft, and "d2θe/ dt2" is engine rotation angular acceleration,

(Te - Tcl) • it • if = Ie • it2 • if2 • d2θe/ dt2; and

said second motion equation is a following equation, in which "W" is vehicle weight, "μ" is a rolling resistance coefficient, "λ" is an air resistance coefficient, "A" is front project area, "V" is vehicle speed, "R" is a wheel radius, "η" is power transfer efficiency, "g" is gravitational acceleration, "Iw" is moment of inertia of an axle shaft and a same rotation portion, "If" is moment of inertia of rotating portion of a differential gear input shaft, "It" is moment of inertia of the transmission, and "d2θax/ dt2" is axle shaft rotation angular acceleration,

Tcl • it • if - (W • (μ + sinθ) + λ • A • V2) • R • η

= (W/g • R2 + (Iw + (If + It • it2) • if2)).

26. (New) A transmission control method for a mechanical transmission according to claim 25, wherein said step (c) includes a sub-step (c1) of changing an engine revolution speed of the internal combustion engine after the gear disengagement is performed with the clutch kept connected and a sub-step (c2) of performing the gear engagement for a gear state after the gear shift with the clutch kept connected when the engine revolution speed is substantially synchronous with a gear revolution speed for the gear stage after the gear shift.

27. (New) A transmission control method for a mechanical transmission according to claim 25, wherein the applicable mechanical transmission is configured so that said friction clutch can be automatically connected and disconnected, and said step (c) includes automatically disconnecting the friction clutch to disengage and engage the gears if gear disengagement is not executed after a commend for gear disengagement is issued.

28. (New) A transmission control apparatus for a mechanical transmission, capable of transmitting an output of an internal combustion engine to wheels through a friction clutch by performing automatic multistate speed change, comprising:

engine torque control means for controlling an engine torque generated by the internal combustion engine so that the value of a transfer torque of the friction clutch is 0 or near 0 when a gear shift of the mechanical transmission is required;

gear shift allowing means for allowing the gear shift of the mechanical transmission when the engine torque is controlled by the engine torque control means so that the value of the transfer torque is 0 or near 0; and

gear shift executing means for disengaging and engaging gears with the clutch kept connected when the gear shift is allowed by the gear shift allowing means,

wherein said friction clutch has a flywheel and a clutch plate capable of being connected to and disconnected from the flywheel, and

said engine torque control means obtains a changed engine torque such that the value of the transfer torque is 0 or near 0 in accordance with a first motion equation for a range from the internal combustion engine to the flywheel and a second motion equation for a range from the friction clutch to each wheel and a position on an axle shaft of a vehicle and controls the internal combustion engine so that the changed engine torque is generated,

wherein said first motion equation is a following equation, in which "Te" is engine torque, "Tcl" is clutch torque, "it" is a transmission gear ratio, "if" is a differential gear ratio, "Ie" is moment of inertia of rotating portion of an engine input shaft, and "d2θe/ dt2" is engine rotation angular acceleration,

(Te - Tcl) • it • if = Ie • it2 • if2 • d2θe/ dt2; and

said second motion equation is a following equation, in which "W" is vehicle weight, "μ" is a rolling resistance coefficient, "λ" is an air resistance coefficient, "A" is front project area, "V" is vehicle speed, "R" is a wheel radius, "η" is power transfer efficiency, "g" is gravitational acceleration, "Iw" is moment of inertia of an axle shaft and a same rotation portion, "If" is

moment of inertia of rotating portion of a differential gear input shaft, "It" is moment of inertia of the transmission, and "d2θax/ dt2" is axle shaft rotation angular acceleration,

$$Tcl \cdot it \cdot if - (W \cdot (\mu + \sin\theta) + \lambda \cdot A \cdot V2) \cdot R \cdot \eta$$

$$= (W/g \cdot R2 + (Iw + (If + It \cdot it2) \cdot if2)) \cdot d2\theta ax/ dt2.$$

29. (New) A transmission control apparatus for a mechanical transmission according to claim 28, further comprising:

engine revolution speed detecting means for detecting an engine revolution speed of the internal combustion engine and gear revolution speed detecting means for detecting a gear revolution speed for a gear stage after the gear shift,

wherein said gear shift executing means changes the engine revolution speed of the internal combustion engine after the gear disengagement is performed with the clutch kept connected and performs the gear engagement for the gear stage after the gear shift with the clutch kept connected when the engine revolution speed is substantially synchronous with the gear revolution speed for the gear stage after the gear shift.

30. (New) A transmission control apparatus for a mechanical transmission according to claim 28, wherein said friction clutch is configured to be able to be automatically connected and disconnected, and the gear shift executing means automatically disconnects the friction clutch to disengage and engage the gears if gear disengagement is not executed after a commend for gear disengagement is issued.